660TTT*1808E1660

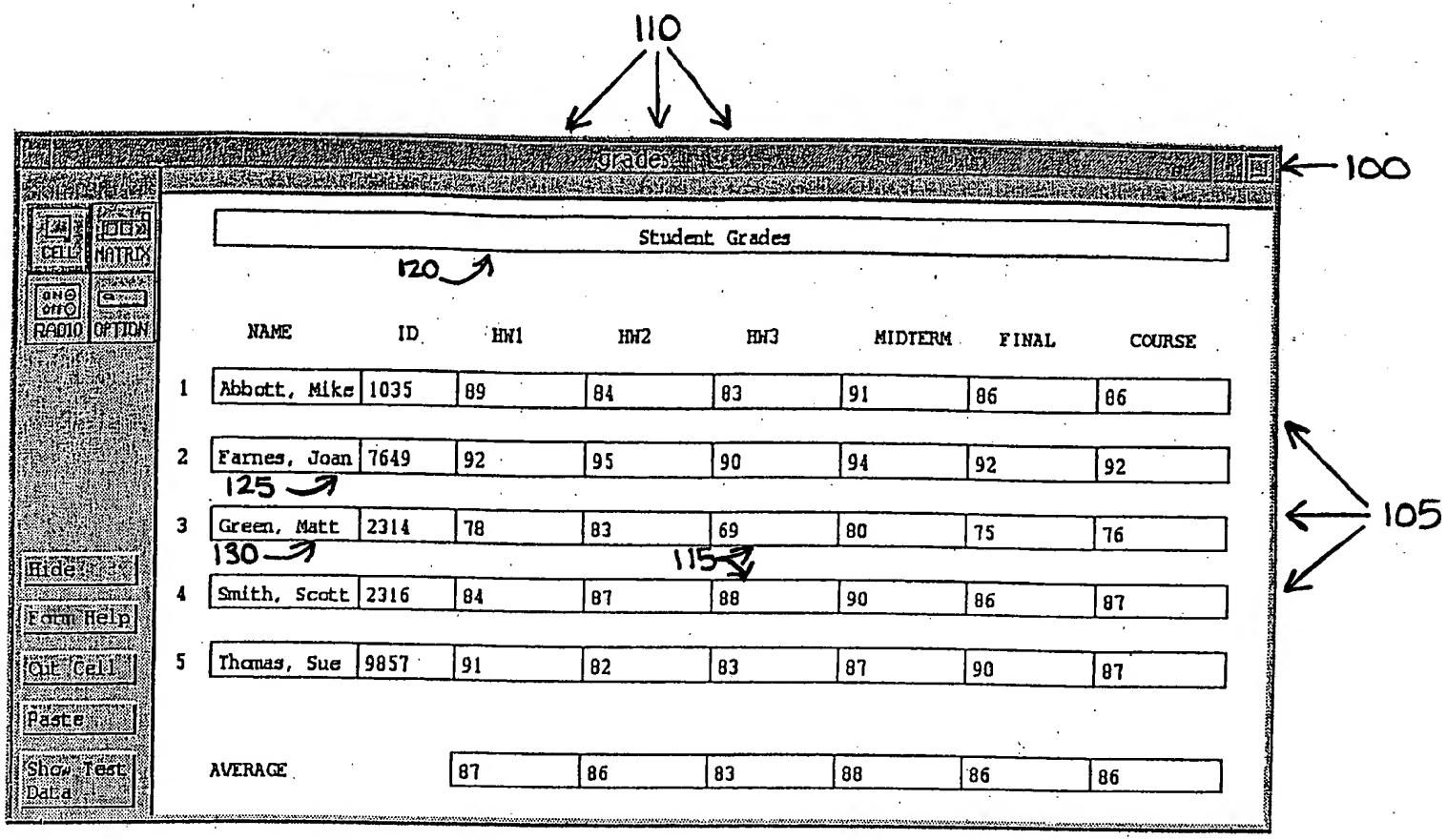

FIG. 1

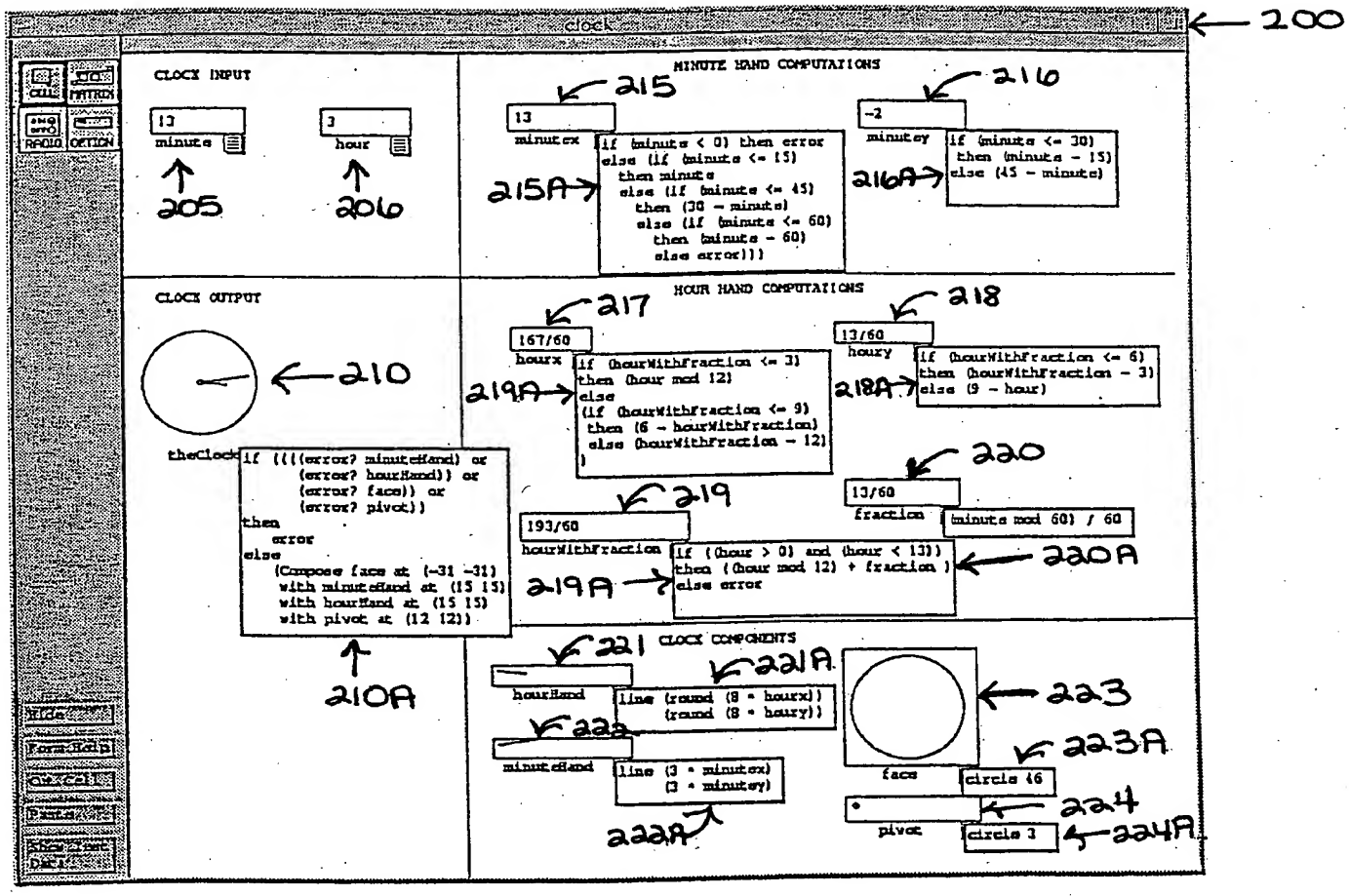
clock
200
CLOCK INPUT
13
minute
205
3
hour
206
MINUTE HAND COMPUTATIONS
215
13
minutex
215A
if (minute < 0) then error
else (if (minute <= 15)
then minute
else (if (minute <= 45)
then (30 - minute)
else (if (minute <= 60)
then (minute - 60)
else error)))
216
-2
minutey
216A
if (minute <= 30)
then (minute - 15)
else (45 - minute)
CLOCK OUTPUT
210
theClock
if ((((error? minuteHand) or
(error? hourHand)) or
(error? face)) or
(error? pivot))
then
error
else
(Compose face at (-31 -31)
with minuteHand at (15 15)
with hourHand at (15 15)
with pivot at (12 12))
210A
HOUR HAND COMPUTATIONS
217
167/60
hourx
219A
if (hourWithFraction <= 3)
then (hour mod 12)
else
(if (hourWithFraction <= 9)
then (6 - hourWithFraction)
else (hourWithFraction - 12)
)
218
13/60
houry
218A
if (hourWithFraction <= 6)
then (hourWithFraction - 3)
else (9 - hour)
220
13/60
fraction
(minute mod 60) / 60
219
193/60
hourWithFraction
219A
if ((hour > 0) and (hour < 13))
then ((hour mod 12) + fraction)
else error
220A
CLOCK COMPONENTS
221
hourHand
221A
line (round (8 * hourx))
(round (8 * houry))
222
minuteHand
222A
line (3 * minutex)
(3 * minutey)
223
face
circle 16
223A
224
pivot
circle 3
224A

FIG. 2

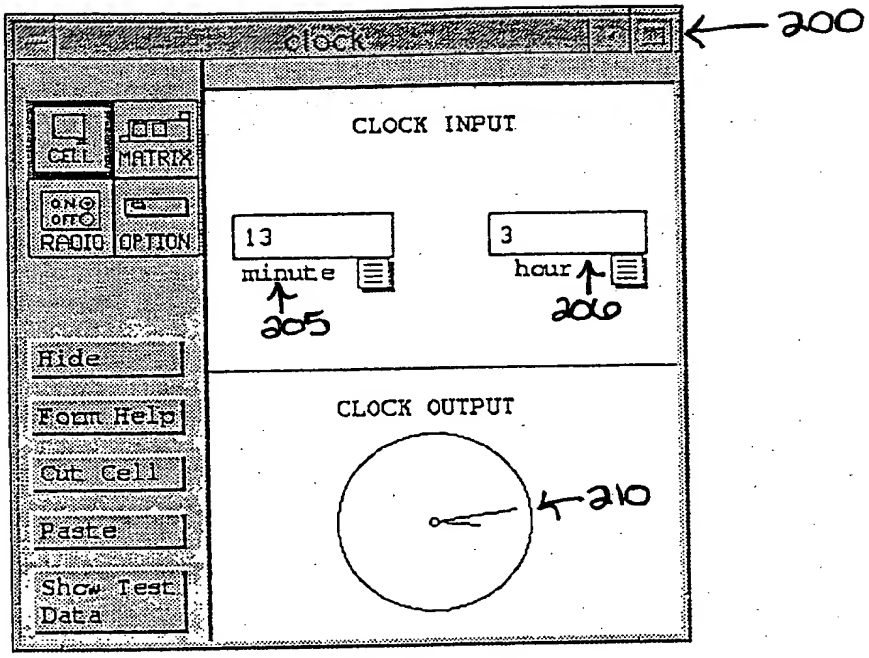
clock
200
CELL
MATRIX
RADIO
OPTION
Hide
Form Help
Cut Cell
Paste
Show Test Data
CLOCK INPUT
13
minute
205
3
hour
206
CLOCK OUTPUT
210

FIG. 3

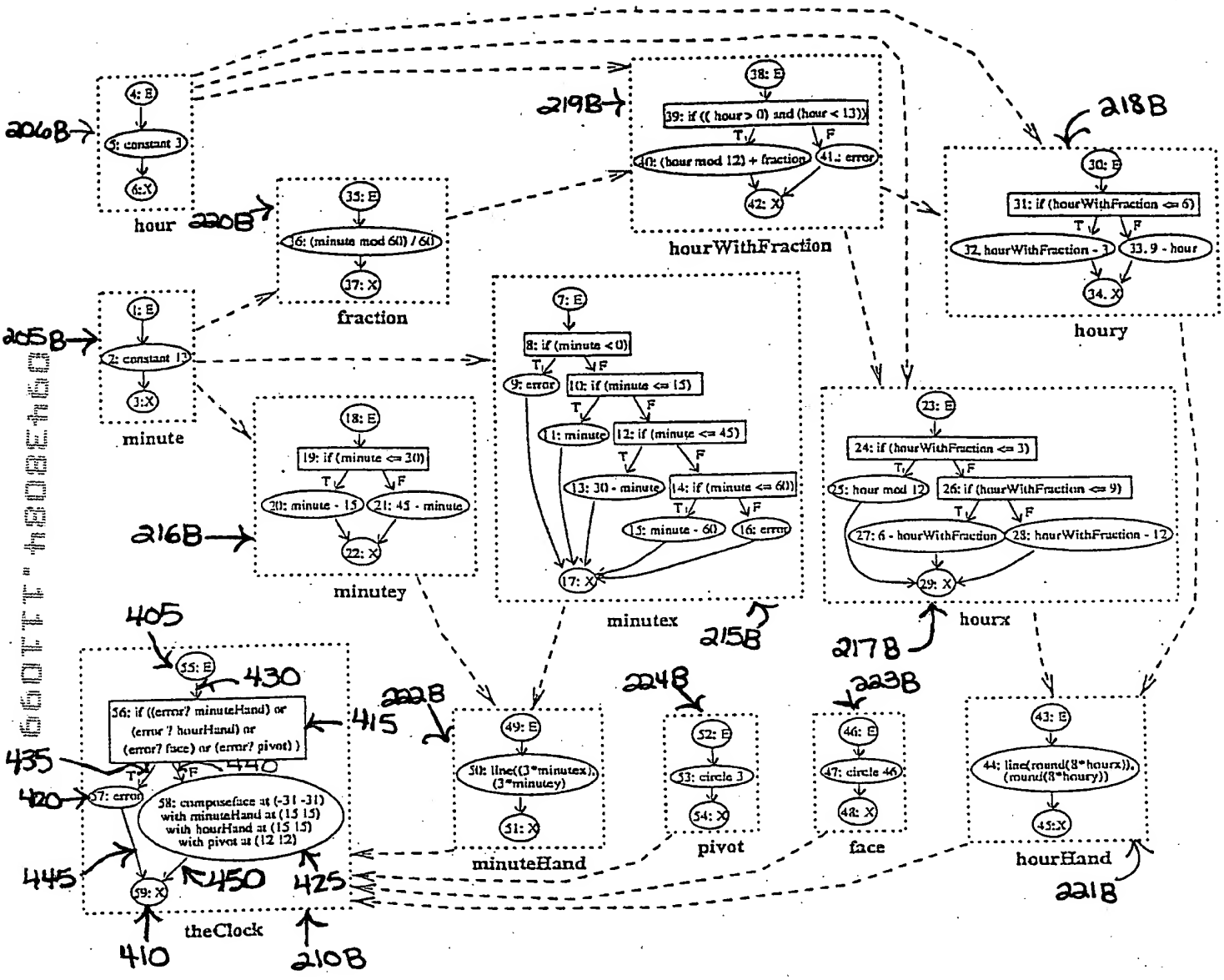
4: E
5: constant 3
6: X
hour
206B
35: E
36: (minute mod 60) / 60
37: X
fraction
220B
38: E
39: if ((hour > 0) and (hour < 13))
T
F
40: (hour mod 12) + fraction
41: error
42: X
hourWithFraction
219B
30: E
31: if (hourWithFraction <= 6)
T
F
32. hourWithFraction - 3
33. 9 - hour
34. X
houry
218B
1: E
2: constant 15
3: X
minute
205B
18: E
19: if (minute <= 30)
T
F
20: minute - 15
21: 45 - minute
22: X
minutey
216B
7: E
8: if (minute < 0)
T
F
9: error
10: if (minute <= 15)
T
F
11: minute
12: if (minute <= 45)
T
F
13: 30 - minute
14: if (minute <= 60)
T
F
15: minute - 60
16: error
17: X
minutex
215B
23: E
24: if (hourWithFraction <= 3)
T
F
25: hour mod 12
26: if (hourWithFraction <= 9)
T
F
27: 6 - hourWithFraction
28: hourWithFraction - 12
29: X
hourx
217B
405
55: E
430
56: if ((error? minuteHand) or (error ? hourHand) or (error? face) or (error? pivot))
415
T
F
440
435
420
57: error
58: composeface at (-31 -31) with minuteHand at (15 15) with hourHand at (15 15) with pivot at (12 12)
445
450
425
59: X
theClock
410
210B
222B
49: E
50: line((3*minutex), (3*minutey)
51: X
minuteHand
224B
52: E
53: circle 3
54: X
pivot
223B
46: E
47: circle 46
48: X
face
43: E
44: line(round(8*hourx)), (round(8*houry))
45: X
hourHand
221B

FIG. 4

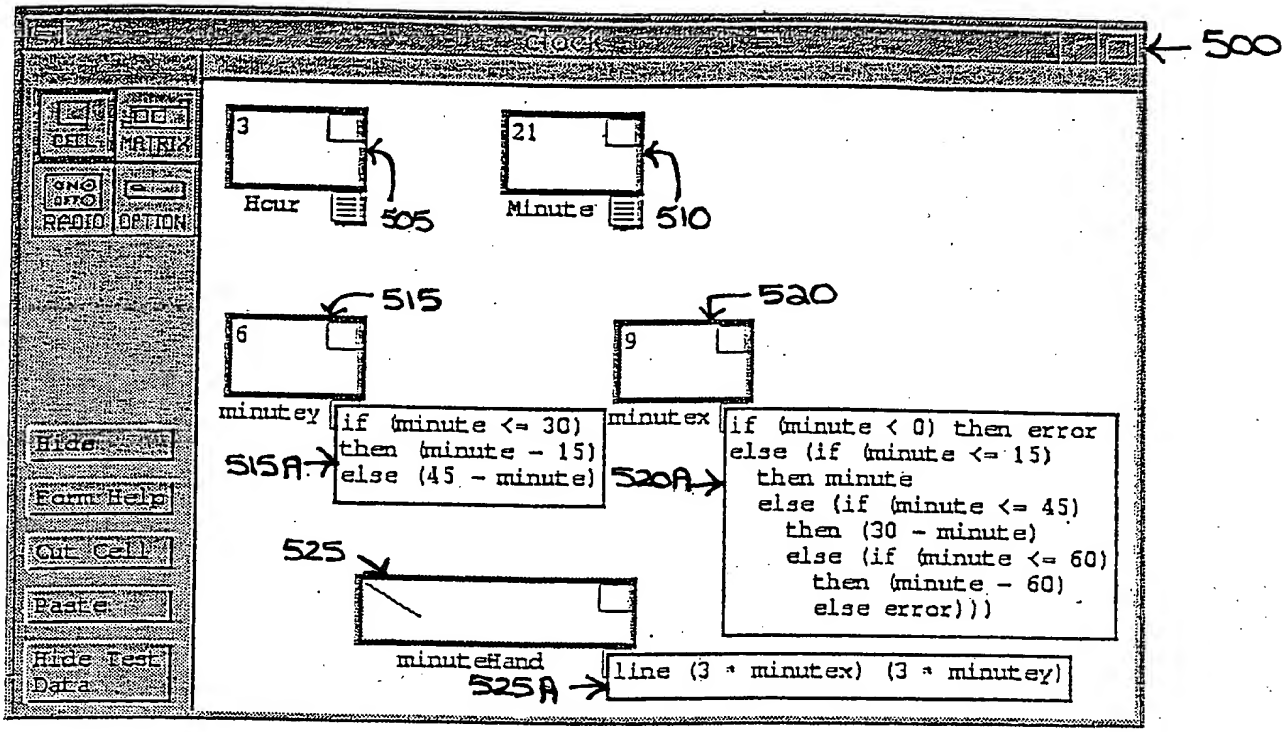
clock
500
MATRIX
RADIO
OPTION
Hide
Form Help
Cut Cell
Paste
Hide Test Data
3
Hour
505
21
Minute
510
515
6
minutey
if (minute <= 30)
then (minute - 15)
else (45 - minute)
515A
520
9
minutex
if (minute < 0) then error
else (if (minute <= 15)
then minute
else (if (minute <= 45)
then (30 - minute)
else (if (minute <= 60)
then (minute - 60)
else error)))
520A
525
minuteHand
line (3 * minutex) (3 * minutey)
525A

FIG. 5

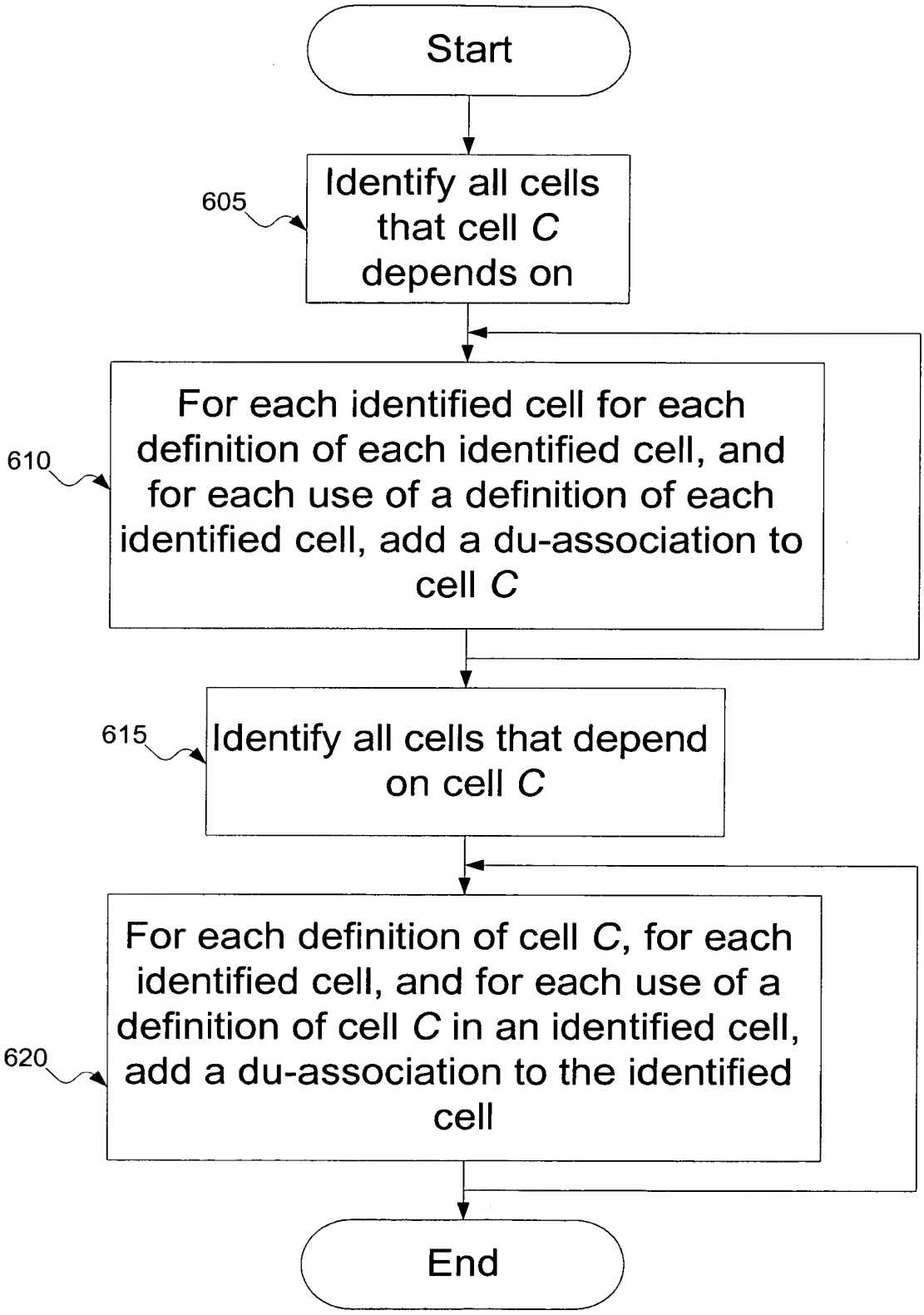
Start
605
Identify all cells that cell C depends on
610
For each identified cell for each definition of each identified cell, and for each use of a definition of each identified cell, add a du-association to cell C
615
Identify all cells that depend on cell C
620
For each definition of cell C, for each identified cell, and for each use of a definition of cell C in an identified cell, add a du-association to the identified cell
End

FIG. 6

660TTT"h808Eh60

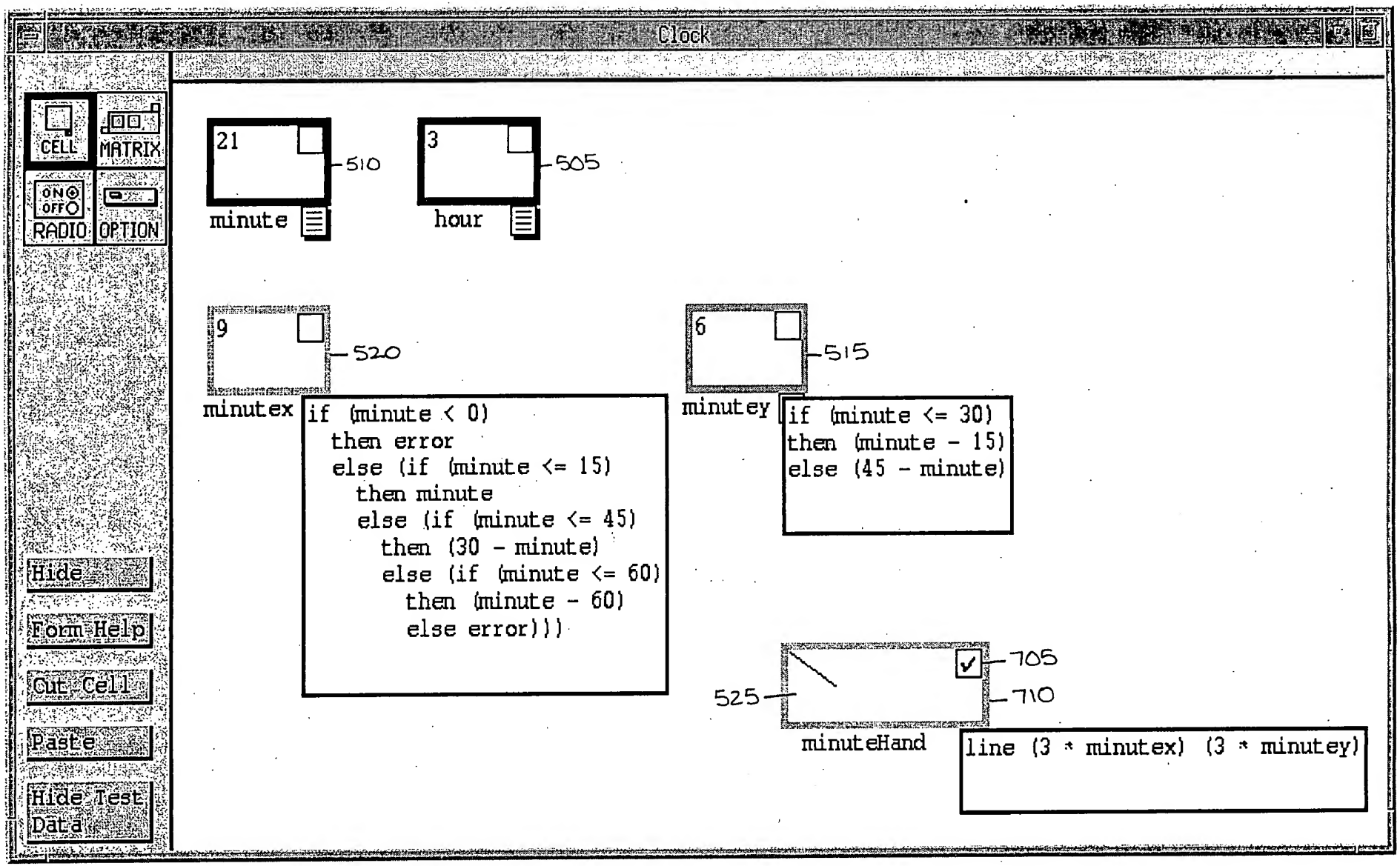

FIG. 7

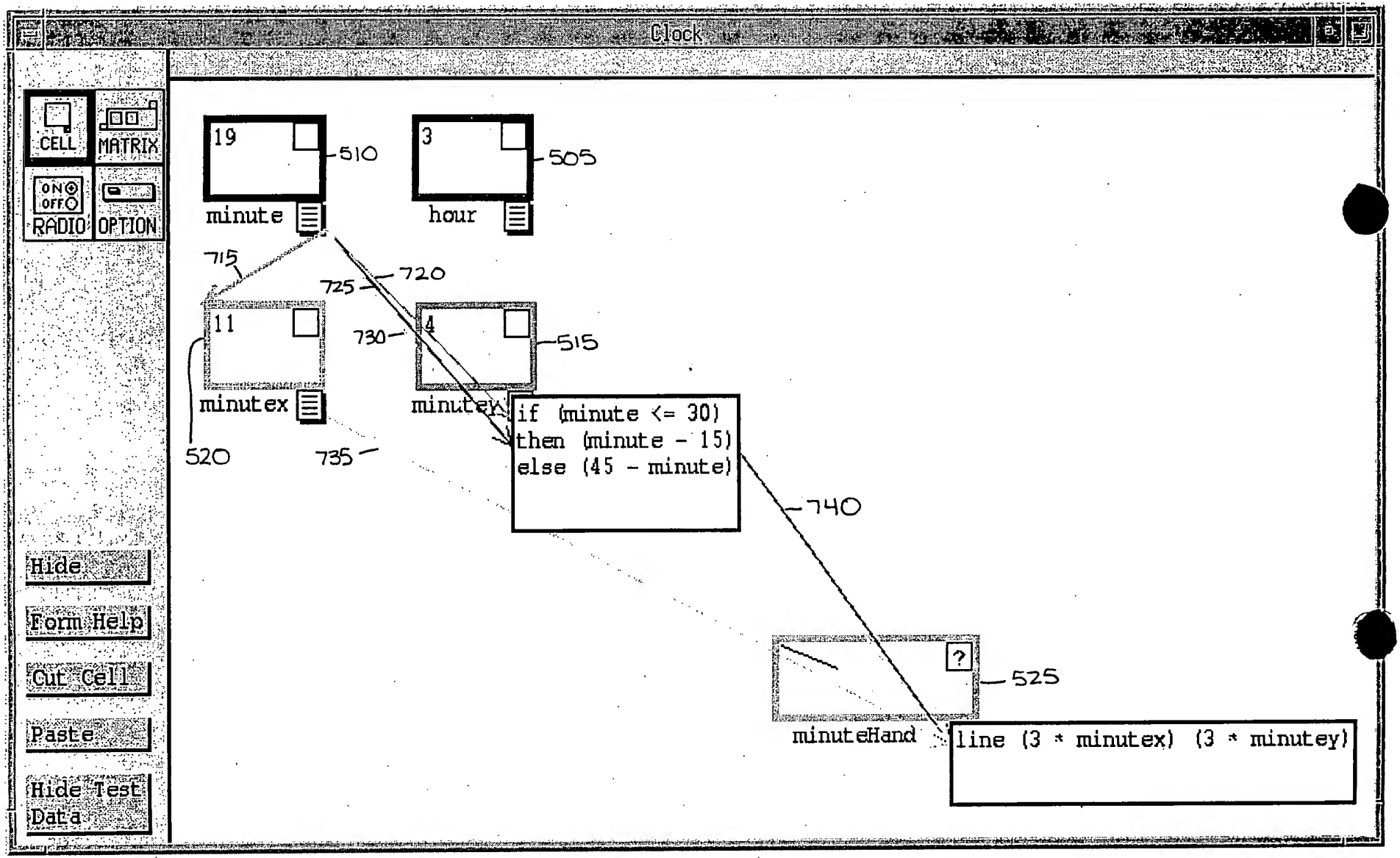
Clock
CELL
MATRIX
ON
OFF
RADIO
OPTION
Hide
Form Help
Cut Cell
Paste
Hide Test Data
19
minute
510
3
hour
505
715
725
720
11
minutex
520
735
730
4
minutey
515
if (minute <= 30)
then (minute - 15)
else (45 - minute)
740
?
minuteHand
525
line (3 * minutex) (3 * minutey)

FIG. 7A

09674794 - 1709684

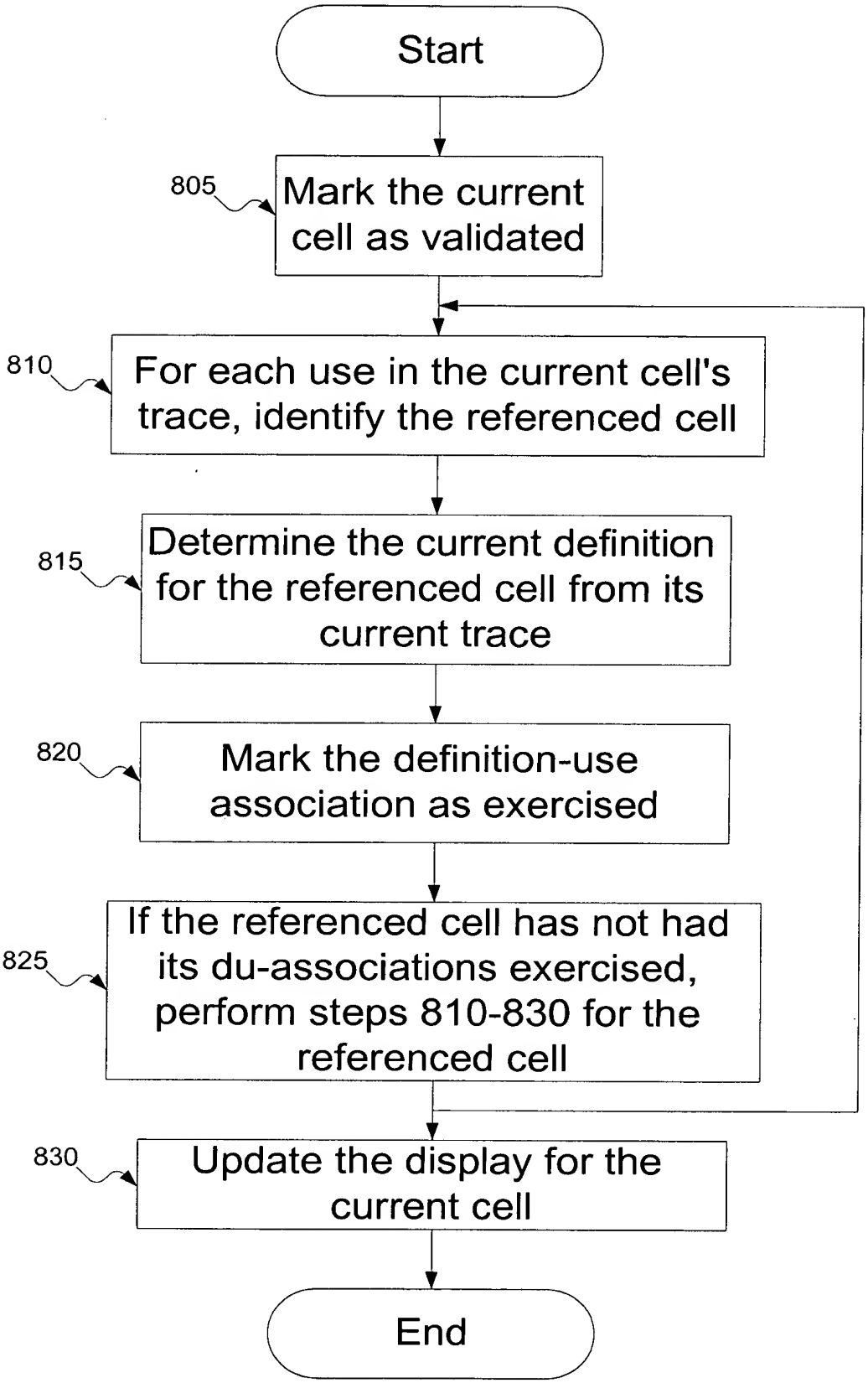

FIG. 8

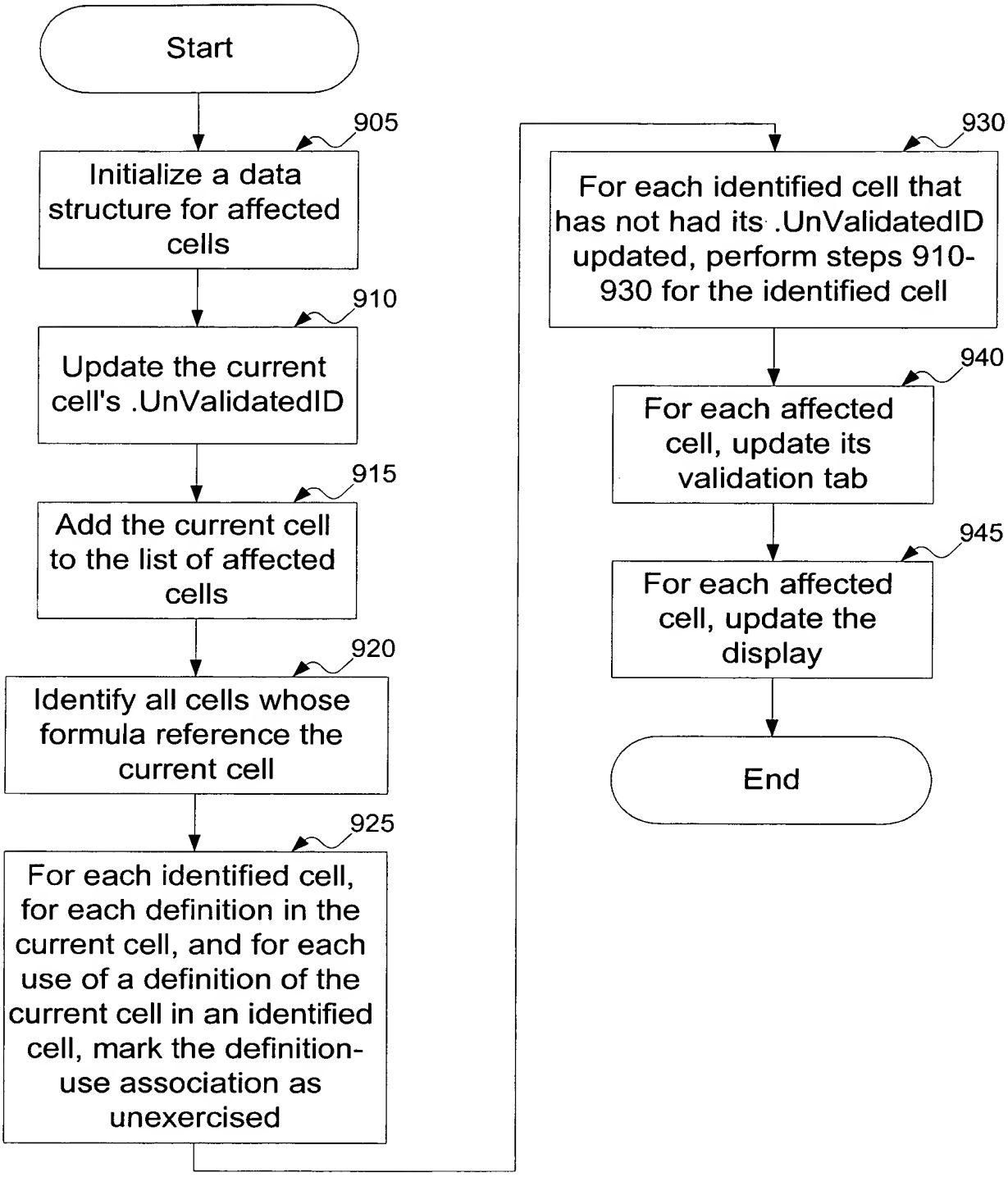
Start
905
Initialize a data structure for affected cells
910
Update the current cell's .UnValidatedID
915
Add the current cell to the list of affected cells
920
Identify all cells whose formula reference the current cell
925
For each identified cell, for each definition in the current cell, and for each use of a definition of the current cell in an identified cell, mark the definition-use association as unexercised
930
For each identified cell that has not had its .UnValidatedID updated, perform steps 910-930 for the identified cell
940
For each affected cell, update its validation tab
945
For each affected cell, update the display
End

FIG. 9

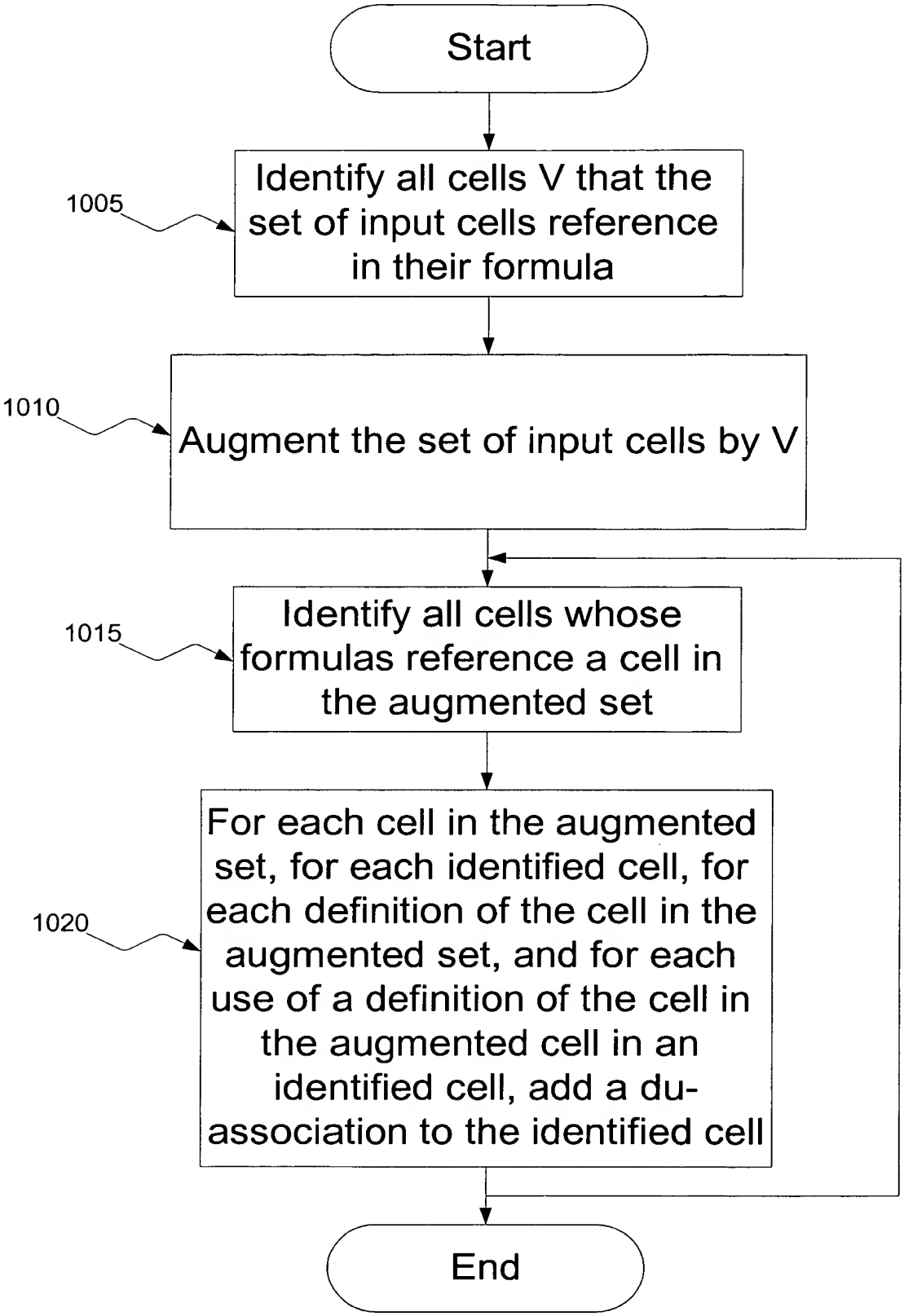
Start
1005
Identify all cells V that the set of input cells reference in their formula
1010
Augment the set of input cells by V
1015
Identify all cells whose formulas reference a cell in the augmented set
1020
For each cell in the augmented set, for each identified cell, for each definition of the cell in the augmented set, and for each use of a definition of the cell in the augmented cell in an identified cell, add a du-association to the identified cell
End

FIG. 10

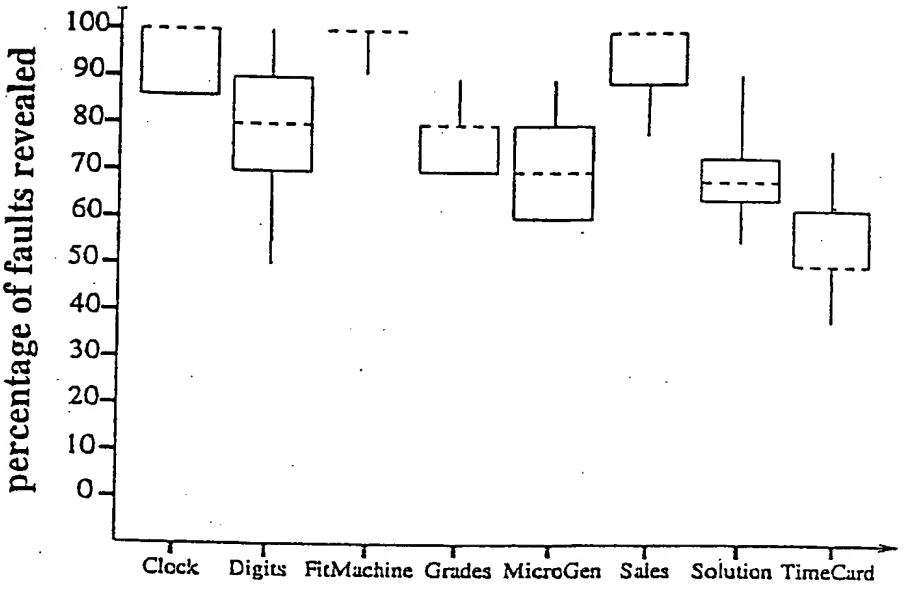
percentage of faults revealed
100
90
80
70
60
50
40
30
20
10
0
Clock
Digits
FitMachine
Grades
MicroGen
Sales
Solution
TimeCard

FIG. 11

660777 h3082h60

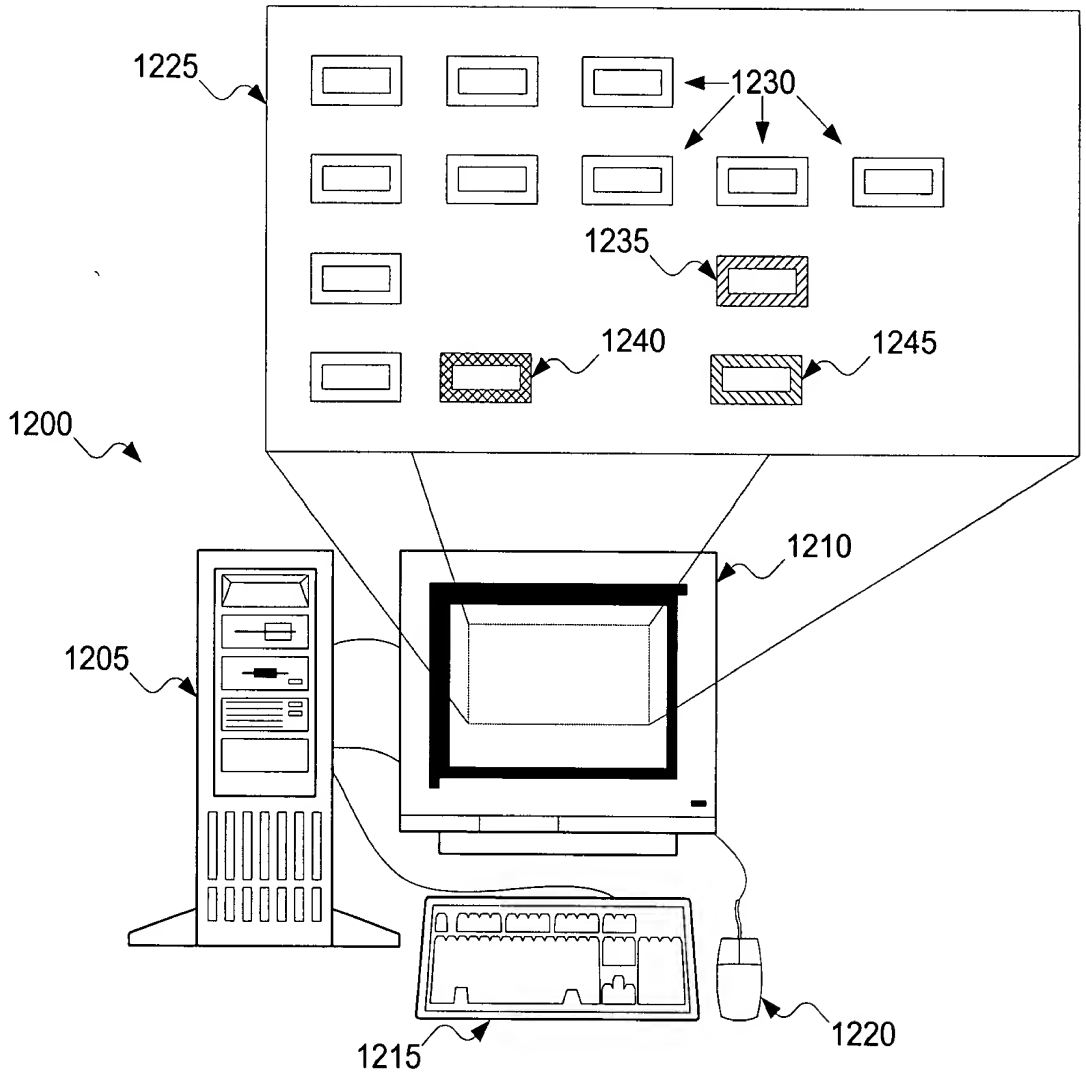

FIG. 12

5605274 - 20050545 - 0

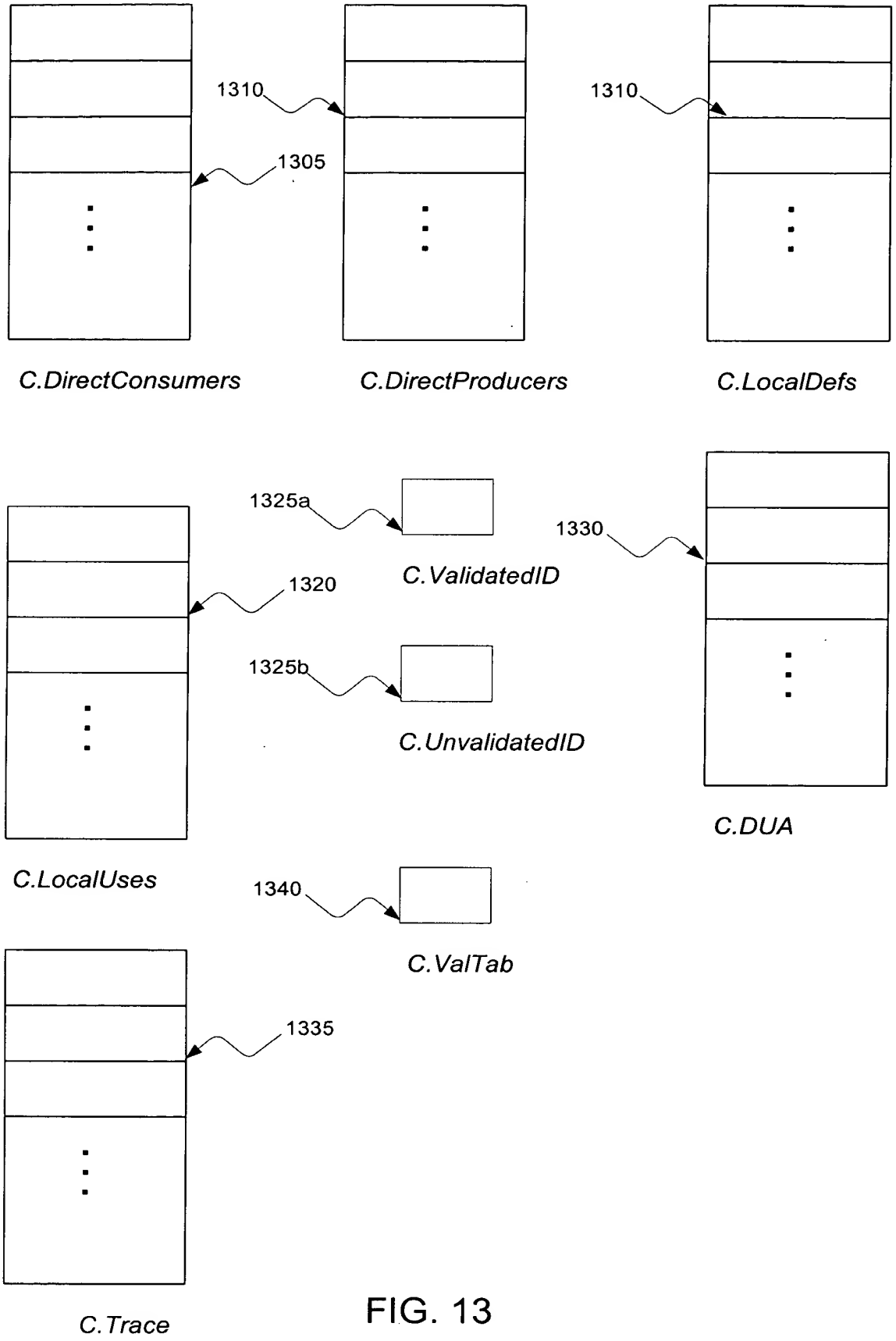

FIG. 13

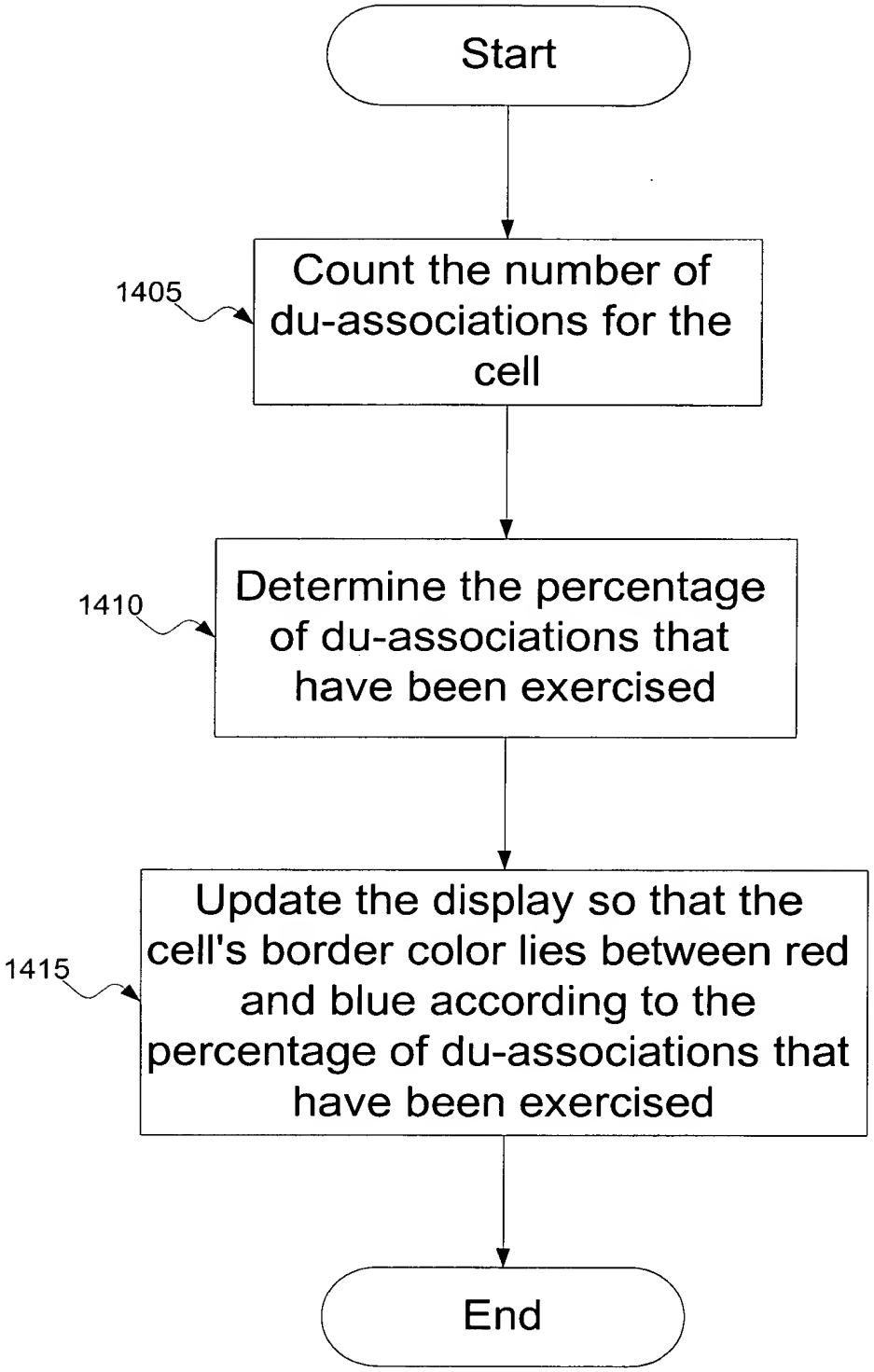
Start
1405
Count the number of du-associations for the cell
1410
Determine the percentage of du-associations that have been exercised
1415
Update the display so that the cell's border color lies between red and blue according to the percentage of du-associations that have been exercised
End

FIG. 14